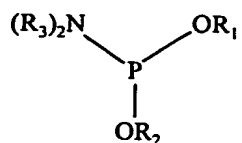


## CLAIMS

We claim:

1. A compound of Formula I:



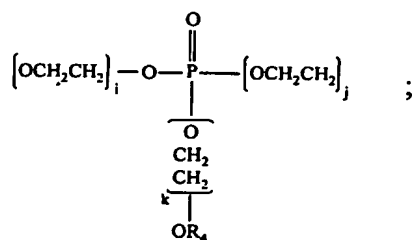
where  $R_1$  is  $-\text{CH}_2\text{CH}_2\text{CN}$ ,  $-\text{CH}_2\text{CH}_3$ ,  $-\text{CH}_3$ , -phenyl optionally substituted by one or more halogens, or  $-\text{[A]}_n\text{-OR}_4$ ;

$R_2$  is  $-\text{CH}_2\text{CH}_2\text{CN}$ ,  $-\text{CH}_2\text{CH}_3$ ,  $-\text{CH}_3$ , -phenyl optionally substituted by one or more halogens, or  $-\text{[B]}_n\text{-OR}_4$ ;

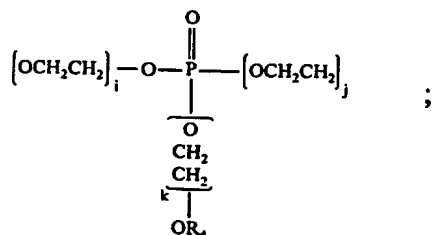
$R_3$  is  $-\text{CH}_3$ ,  $-\text{CH}_2\text{CH}_3$ , or  $-\text{CH}(\text{CH}_3)_2$ ;

$R_4$  is  $-\text{CH}_3$ , -alkyl, -phenyl, or  $-\text{CONH}_2$ ;

A is  $(\text{CH}_2\text{CH}_2\text{O})$ ,  $(\text{CH}_2\text{CH}_2\text{CH}_2\text{O})$ ,  $[\text{OCH}_2\text{CH}_2]_i\text{-O-P(=O)(O-)-[OCH}_2\text{CH}_2]_j$ , or



B is  $(\text{CH}_2\text{CH}_2\text{O})$ ,  $(\text{CH}_2\text{CH}_2\text{CH}_2\text{O})$ ,  $[\text{OCH}_2\text{CH}_2]_i\text{-O-P(=O)(O-)-[OCH}_2\text{CH}_2]_j$ , or



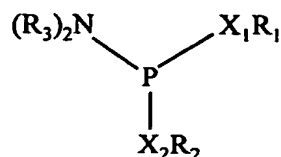
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22 i, j, k, n are 1-20; and

23 where at least  $R_1$  is  $[A]_n-OR_4$  or  $R_2$  is  $[B]_n-OR_4$  or  $R_1$  is  $[A]_n-OR_4$  and  $R_2$  is  $[B]_n-OR_4$ .

2. A compound of Formula II:



where  $X_1$  is O, NH, or S;

$X_2$  is O, NH, or S;

Where at least  $X_1$  is NH or S, or  $X_2$  is NH or S;

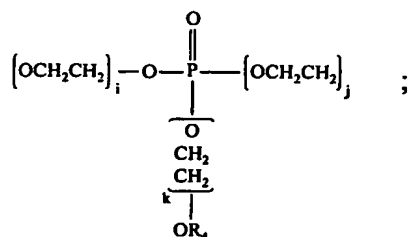
$R_1$  is  $-\text{CH}_2\text{CH}_2\text{CN}$ ,  $-\text{CH}_2\text{CH}_3$ ,  $-\text{CH}_3$ , -phenyl optionally substituted by one or more halogens, or  $-\text{[A]}_n\text{-OR}_4$ ;

$R_2$  is  $-\text{CH}_2\text{CH}_2\text{CN}$ ,  $-\text{CH}_2\text{CH}_3$ ,  $-\text{CH}_3$ , -phenyl optionally substituted by one or more halogens, or  $-\text{[B]}_n\text{-OR}_4$ ;

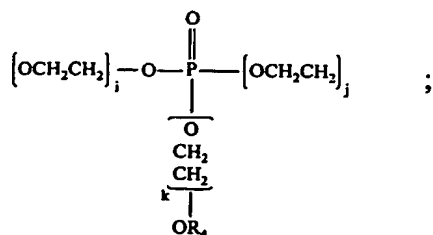
$R_3$  is  $-\text{CH}_3$ ,  $-\text{CH}_2\text{CH}_3$ , or  $-\text{CH}(\text{CH}_3)_2$ ;

$R_4$  is  $-\text{CH}_3$ , -alkyl, -phenyl, or  $-\text{CONH}_2$ ;

A is  $(\text{CH}_2\text{CH}_2\text{O})$ ,  $(\text{CH}_2\text{CH}_2\text{CH}_2\text{O})$ ,  $[\text{OCH}_2\text{CH}_2]_i\text{---O---P(=O)(O}^-\text{)---[OCH}_2\text{CH}_2]_j$ , or



B is  $(\text{CH}_2\text{CH}_2\text{O})$ ,  $(\text{CH}_2\text{CH}_2\text{CH}_2\text{O})$ ,  $[\text{OCH}_2\text{CH}_2]_i\text{---O---P(=O)(O}^-\text{)---[OCH}_2\text{CH}_2]_j$ , or



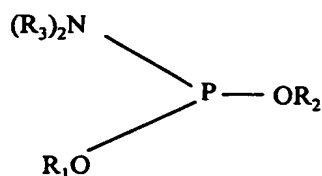
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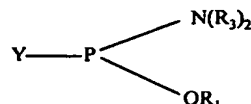
25 i, j, k, n are 1-20; and

26 where at least  $R_1$  is  $[A]_n-OR_4$  or  $R_2$  is  $-[B]_n-OR_4$  or  $R_1$  is  $[A]_n-OR_4$  and  $R_2$  is  $[B]_n-OR_4$ .

3. A process for preparing a compound of Formula I:



comprising the step of reacting HO-R<sub>2</sub> with



wherein Y is a halogen;

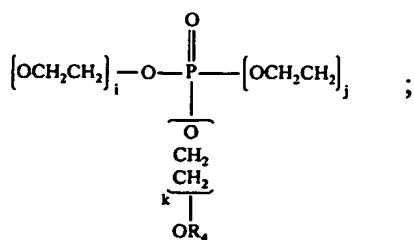
R<sub>1</sub> is -CH<sub>2</sub>CH<sub>2</sub>CN, -CH<sub>2</sub>CH<sub>3</sub>, -CH<sub>3</sub>, -phenyl optionally substituted by one or more halogens, or -[A]<sub>n</sub>-OR<sub>4</sub>;

R<sub>2</sub> is -CH<sub>2</sub>CH<sub>2</sub>CN, -CH<sub>2</sub>CH<sub>3</sub>, -CH<sub>3</sub>, -phenyl optionally substituted by one or more halogens, or -[B]<sub>n</sub>-OR<sub>4</sub>;

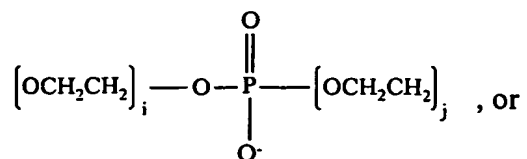
R<sub>3</sub> is -CH<sub>3</sub>, -CH<sub>2</sub>CH<sub>3</sub>, or -CH(CH<sub>3</sub>)<sub>2</sub>;

R<sub>4</sub> is -CH<sub>3</sub>, -alkyl, -phenyl, or -CONH<sub>2</sub>;

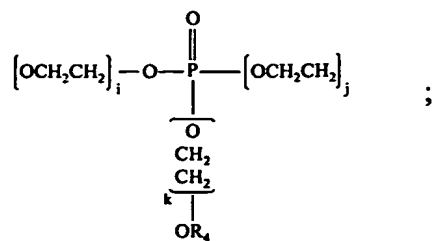
A is (CH<sub>2</sub>CH<sub>2</sub>O), (CH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>O),  $[OCH_2CH_2]_i - O - P(=O)(O^-) - [OCH_2CH_2]_j$ , or



23

24 B is (CH<sub>2</sub>CH<sub>2</sub>O), (CH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>O),

25



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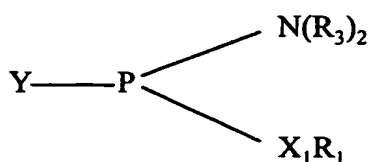
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29 i, j, k, n are 1-20; and

30 where at least R<sub>1</sub> is [A]<sub>n</sub>-OR<sub>4</sub> or R<sub>2</sub> is [B]<sub>n</sub>-OR<sub>4</sub> or R<sub>1</sub> is [A]<sub>n</sub>-OR<sub>4</sub> and R<sub>2</sub> is [B]<sub>n</sub>-OR<sub>4</sub>.

4. A process for preparing a compound of Formula II comprising the step of reacting  $R_2-X_2H$  with:



where  $X_2$  is O, NH, or S;

$X_1$  is O, NH or S;

Y is a halogen;

$R_1$  is  $-\text{CH}_2\text{CH}_2\text{CN}$ ,  $-\text{CH}_2\text{CH}_3$ ,  $-\text{CH}_3$ , -phenyl optionally substituted by one or more halogens,

or  $-\text{[A]}_n\text{-OR}_4$ ;

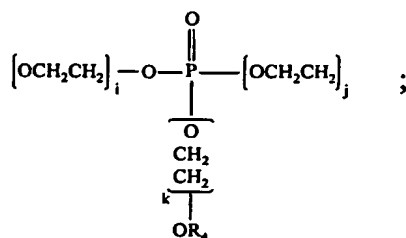
$R_2$  is  $-\text{CH}_2\text{CH}_2\text{CN}$ ,  $-\text{CH}_2\text{CH}_3$ ,  $-\text{CH}_3$ , -phenyl optionally substituted by one or more halogens,

or  $-\text{[B]}_n\text{-OR}_4$ ;

$R_3$  is  $-\text{CH}_3$ ,  $-\text{CH}_2\text{CH}_3$ , or  $-\text{CH}(\text{CH}_3)_2$ ;

$R_4$  is  $-\text{CH}_3$ , -alkyl, -phenyl, or  $-\text{CONH}_2$ ;

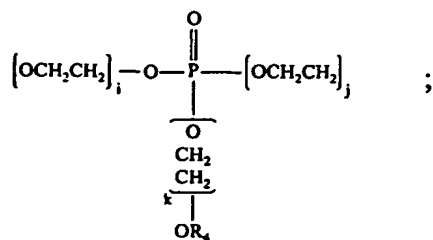
A is  $(\text{CH}_2\text{CH}_2\text{O})$ ,  $(\text{CH}_2\text{CH}_2\text{CH}_2\text{O})$ ,  $[\text{OCH}_2\text{CH}_2]_i\text{---O---P(=O)(O}^-\text{)---[OCH}_2\text{CH}_2]_j$ , or



20

21 B is  $(\text{CH}_2\text{CH}_2\text{O})$ ,  $(\text{CH}_2\text{CH}_2\text{CH}_2\text{O})$ ,  $[\text{OCH}_2\text{CH}_2]_i - \text{O} - \text{P}(\text{O})(\text{O}^-) - [\text{OCH}_2\text{CH}_2]_j$ , or

22



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24

25

26 i, j, k, n are 1-20; and

27 where at least  $\text{R}_1$  is  $[\text{A}]_n - \text{OR}_4$  or  $\text{R}_2$  is  $[\text{B}]_n - \text{OR}_4$  or  $\text{R}_1$  is  $[\text{A}]_n - \text{OR}_4$  and  $\text{R}_2$  is  $[\text{B}]_n - \text{OR}_4$ .



- 1            5.        An oligomeric compound linked to the compound of Formula I.
- 1            6.        A chimeric oligonucleotide comprising a nucleoside linked to the compound  
2 of Formula I.
- 1            7.        A chimeric oligonucleotide comprising a nucleotide linked to the compound of  
2 Formula I.
- 1            8.        A chimeric oligonucleotide comprising an oligonucleotide linked to the  
2 compound of Formula I.
- 1            9.        A compound comprising a peptide linked to the compound of Formula I.
- 1            10.       A compound comprising an amino acid linked to the compound of Formula I.
- 1            11.       A compound comprising an oligosaccharide linked to the compound of  
2 Formula I.
- 1            12.       A compound comprising a sugar moiety linked to the compound of Formula I.
- 1            13.       A growing oligomeric chain coupled to the compound of Formula I.

1           14.    A method of using the compound of Formula I comprising the steps of  
2    providing a nucleoside and covalently bonding the compound to the nucleoside to form a  
3    chemically stable molecule.

1           15.    A method of using the compound of Formula I comprising the steps of  
2    providing an oligonucleotide and covalently bonding the compound to the oligonucleotide to  
3    form a chemically stable molecule.

1           16.    A method of terminating the elongation of failure sequences during synthesis  
2    of an oligomer comprising the steps of:

- 3                   a)     providing a compound of Formula I; and  
4                   b)     reacting the compound with the failure sequences.

1           17.    A method of modifying the properties of a molecule comprising the steps of:

- 2                   a)     providing a compound of Formula I; and  
3                   b)     reacting the compound with said molecule to modify the properties of  
4    the molecule.

1           18.    A method of modifying the surface properties of a support comprising the  
2 steps of:

- 3                   a)     providing a compound of Formula I; and  
4                   b)     reacting the compound with the support to modify the surface  
5 properties of the support.

1           19.    A method of preventing non-specific bonding of a molecule to reactive groups  
2 on a support comprising reacting the compound of Formula I with the reactive groups on the  
3 support.

1           20.    A method of controlling the density of reactive groups on a support  
2 comprising:

- 3                   a)     providing a pre-determined amount of the compound of Formula I; and  
4                   b)     reacting the compound with the reactive groups to obtain a desired  
5 density.

1           21.    A method of oligonucleotide synthesis comprising contacting the growing  
2 oligonucleotide chain with the compound of Formula I.

1           22.    A method of synthesizing an oligonucleotide comprising the steps of :

- 2                   a)     attaching a first nucleoside to a support;
- 3                   b)     coupling a second nucleoside to the first nucleoside;
- 4                   c)     reacting any of the first nucleoside which remain uncoupled with a
- 5   compound of the Formula I; and
- 6                   d)     repeating steps b and c iteratively until the oligonucleotide is formed.

1           23.    The method of claim 22 wherein the compound of Formula I links to a

2   reactive group selected from the group consisting of OH, NH<sub>2</sub> and carboxylate ester.

1           24.    The method of claim 22 wherein the support is a solid support.

1           25.    The method of claim 22 wherein the nucleoside is a phosphoramidite

2   nucleoside.

1           26.    A method of synthesizing an oligonucleotide comprising the steps of:

- 2                   a)     providing a reagent comprising the compound of Formula I; and
- 3                   b)     using the reagent to covalently bond to reactive groups on the growing
- 4   oligonucleotide chain.

1           27.    The method of claim 26 wherein the method of synthesizing the

2   oligonucleotide is solid-phase synthesis.

1           28.    The method of claim 26 wherein the method of synthesizing the  
2   oligonucleotide is solution-phase synthesis.

1           29.    A product made by the method of claim 26.

1           30.    A biological chip comprising the product of claim 29.

1           31.    A microarray comprising the product of claim 29.

1           32.    An assay comprising the product of claim 29.

1           33.    An oligomeric compound linked to the compound of Formula II.

1           34.    A chimeric oligonucleotide comprising a nucleoside linked to the compound  
2   of Formula II.

1           35.    A chimeric oligonucleotide comprising a nucleotide linked to the compound of  
2   Formula II.

1           36.    A chimeric oligonucleotide comprising an oligonucleotide linked to the  
2   compound of Formula II.

1           37.    A compound comprising a peptide linked to the compound of Formula II.

- 1           38.    A compound comprising an amino acid linked to the compound of Formula II.
- 1           39.    A compound comprising an oligosaccharide linked to the compound of  
2   Formula II.
- 1           40.    A compound comprising a sugar moiety linked to the compound of Formula  
2   II.
- 1           41.    A growing oligomeric chain coupled to the compound of Formula II.
- 1           42.    A method of using the compound of Formula II comprising the steps of  
2   providing a nucleoside and covalently bonding the compound to the nucleoside to form a  
3   chemically stable molecule.
- 1           43.    A method of using the compound of Formula II comprising the steps of  
2   providing an oligonucleotide and covalently bonding the compound to the oligonucleotide to  
3   form a chemically stable molecule.
- 1           44.    A method of terminating the elongation of failure sequences during synthesis  
2   of an oligomer comprising the steps of:
- 3               a)    providing a compound of Formula II; and
- 4               b)    reacting the compound with the failure sequences.

1           45.    A method of modifying the properties of a molecule comprising the steps of:

2                   a)     providing a compound of Formula II; and

3                   b)     reacting the compound with said molecule to modify the properties of  
4           the molecule.

1           46.    A method of modifying the surface properties of a support comprising the  
2    steps of:

3                   a)     providing a compound of Formula II; and

4                   b)     reacting the compound with the support to modify the surface  
5           properties of the support.

1           47.    A method of preventing non-specific bonding of a molecule to reactive groups  
2    on a support comprising reacting the compound of Formula II with the reactive groups on the  
3    support.

1           48.    A method of controlling the density of reactive groups on a support  
2    comprising:

3                   a)     providing a pre-determined amount of the compound of Formula II;

4           and

5                   b)     reacting the compound with the reactive groups to obtain a desired  
6           density.

1           49.    A method of oligonucleotide synthesis comprising contacting the growing  
2 oligonucleotide chain with the compound of Formula II.

1           50.    A method of synthesizing an oligonucleotide comprising the steps of :  
2               a)    attaching a first nucleoside to a support;  
3               b)    coupling a second nucleoside to the first nucleoside;  
4               c)    reacting any of the first nucleoside which remain uncoupled with a  
5 compound of the Formula II; and  
6               d)    repeating steps b and c iteratively until the oligonucleotide is formed.

1           51.    The method of claim 50 wherein the compound of Formula II links to a  
2 reactive group selected from the group consisting of OH, NH<sub>2</sub> and carboxylate ester.

1           52.    The method of claim 50 wherein the support is a solid support.

1           53.    The method of claim 50 wherein the nucleoside is a phosphoramidite  
2 nucleoside.

1           54.    A method of synthesizing an oligonucleotide comprising the steps of:  
2               a)    providing a reagent comprising the compound of Formula II; and  
3               b)    using the reagent to covalently bond to reactive groups on the growing  
4 oligonucleotide chain.



1           55.    The method of claim 54 wherein the method of synthesizing the  
2 oligonucleotide is solid-phase synthesis.

1           56.    The method of claim 54 wherein the method of synthesizing the  
2 oligonucleotide is solution-phase synthesis.

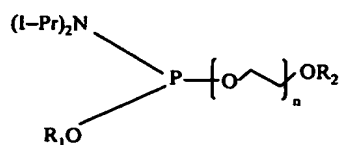
1           57.    A product made by the method of claim 54.

1           58.    A biological chip comprising the product of claim 57.

1           59.    A microarray comprising the product of claim 57.

1           60.    An assay comprising the product of claim 57.

61. A compound according to Claim 1 having the following formula:



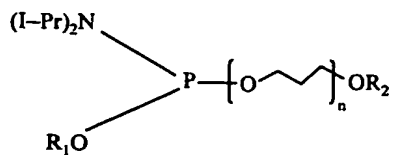
where  $\text{R}_1$  is  $-\text{CH}_2\text{CH}_2\text{CN}$  or  $-\text{CH}_3$ ;

$\text{R}_2$  is  $-\text{CH}_3$ , -alkyl, -phenyl, or  $-\text{CONH}_2$ ;

I-Pr is isopropyl; and

$n$  is 1 to 20.

62. A compound according to Claim 1 having the following formula:



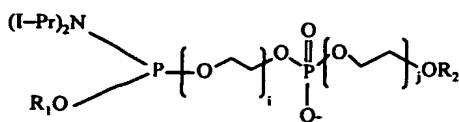
where  $\text{R}_1$  is  $-\text{CH}_2\text{CH}_2\text{CN}$  or  $-\text{CH}_3$ ;

$\text{R}_2$  is  $-\text{CH}_3$ , -alkyl, -phenyl, or  $-\text{CONH}_2$ ;

I-Pr is isopropyl; and

$n$  is 1 to 20.

63. A compound according to Claim 1 having the following formula:



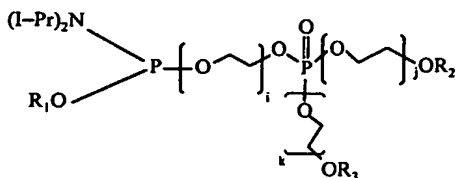
where R<sub>1</sub> is -CH<sub>2</sub>CH<sub>2</sub>CN or -CH<sub>3</sub>;

**R<sub>2</sub> is -CH<sub>3</sub>, -alkyl, -phenyl, or -CONH<sub>2</sub>;**

I-Pr is isopropyl; and

i and j are 1 to 20.

64. A compound according to Claim 1 having the following formula:



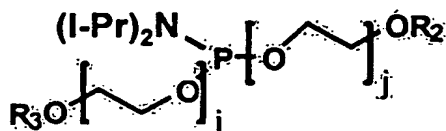
where R<sub>1</sub> is -CH<sub>2</sub>CH<sub>2</sub>CN or -CH<sub>3</sub>;

R<sub>2</sub> is -CH<sub>3</sub>, -alkyl, -phenyl, or -CONH<sub>2</sub>;

I-Pr is isopropyl; and

**i, j, and k are 1 to 20.**

65. A compound according to Claim 1 having the following formula:

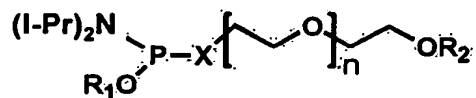


where  $\text{R}_2$  and  $\text{R}_3$  are  $-\text{CH}_3$ , -alkyl, or -phenyl;

I-Pr is isopropyl; and

$i$  and  $j$  are 1 to 20.

66. A compound according to Claim 2 having the following formula:



where  $\text{R}_1$  is  $-\text{CH}_2\text{CH}_2\text{CN}$  or  $-\text{CH}_3$ ;

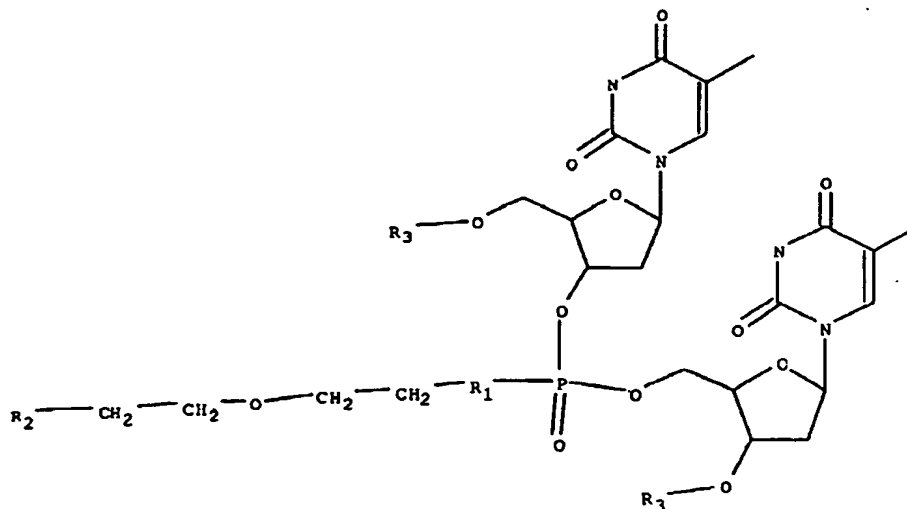
$\text{R}_2$  is  $-\text{CH}_3$ , -alkyl, -phenyl, or  $-\text{CONH}_2$ ;

I-Pr is isopropyl;

$n$  is 1 to 20; and

X is NH or S.

1           67.    A chimeric oligonucleotide of the formula:



10     $R_1$  is O, S, or NH;

11     $R_2$  is OMe, OEt, Ak, Cy, Cb, Hy, or A;

12     $R_3$  is OH, Ak, Cy, Cb, or Hy;

13    A is any atom except H;

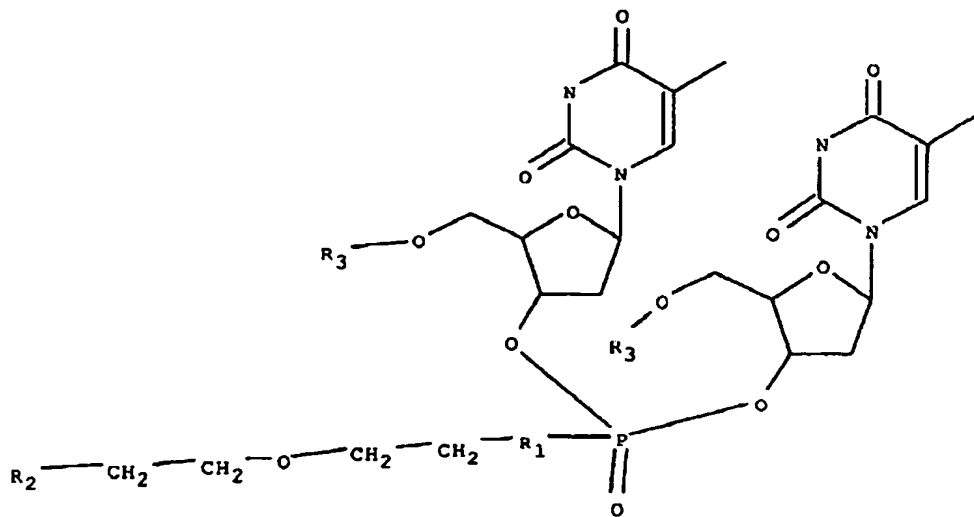
14    Ak is any alkyl chain;

15    Cy is any cyclic compound;

16    Cb is any carbocyclic compound; and

17    Hy is any heterocyclic compound.

68. A chimeric oligonucleotide of the formula:



R<sub>1</sub> is O, S, or NH;

R<sub>2</sub> is OMe, OEt, Ak, Cy, Cb, Hy, or A;

R<sub>3</sub> is OH, Ak, CY, Cb, or Hy;

A is any atom except H;

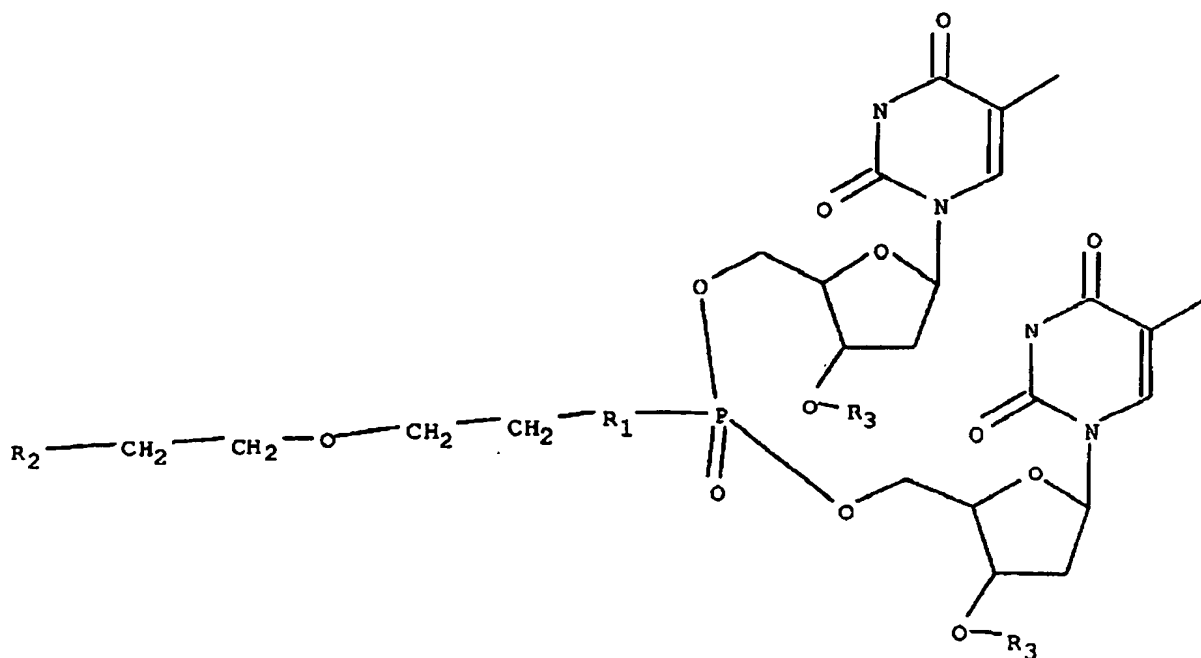
Ak is any alkyl chain;

Cy is any cyclic compound;

Cb is any carbocyclic compound; and

Hy is any heterocyclic compound.

- 1            69.    A chimeric oligonucleotide of the formula:



- 2    R<sub>1</sub> is O, S, or NH;  
3    R<sub>2</sub> is OMe, OEt, Ak, Cy, Cb, Hy, or A;  
4    R<sub>3</sub> is OH, Ak, Cy, Cb, or Hy;  
5    A is any atom except H;  
6    Ak is any alkyl chain;  
7    Cy is any cyclic compound;  
8    Cb is any carbocyclic compound; and  
9    Hy is any heterocyclic compound.